

CLAIMS

What is claimed is:

- 5 1. A method for identifying one or more periods of minimal motion for a heart, comprising the steps of:
 - acquiring at least one set of electrical data representative of cardiac motion and
 - at least one set of non-electrical data representative of cardiac motion;
 - generating a set of multi-input motion data comprising the sets of electrical and
 - 10 non-electrical data; and
 - extracting one or more periods of minimal motion for the heart from the set of multi-input motion data.
- 15 2. The method, as recited in claim 1, wherein the set of multi-input motion data further comprises one or more sets of motion data for one or more proximate organs.
3. The method, as recited in claim 1, wherein the step of acquiring comprises measuring a set of electrical data representative of cardiac motion using electrical sensors.
- 20 4. The method, as recited in claim 1, wherein the step of acquiring comprises measuring a set of non-electrical data representative of cardiac motion using mechanical sensors.
- 25 5. The method, as recited in claim 1, wherein the step of acquiring comprises measuring the motion of the heart from one or more images.
6. The method, as recited in claim 5, wherein the one or more images are derived from one of pre-acquisition image data, unreconstructed acquisition image data, and
- 30 reconstructed acquisition image data.
7. The method as recited in claim 1, further comprising the step of determining a set of motion compensation factors from the one or more periods of minimal motion.

8. The method as recited in claim 1, further comprising the step of determining two or more gating points from the one or more periods of minimal motion.

5 9. The method as recited in claim 1, further comprising the step of validating the one or more periods of minimal motion.

10. A method for identifying one or more periods of minimal motion, comprising the steps of:

10 acquiring at least one set of non-electrical data representative of cardiac motion and one or more sets of data representative of respiratory motion;

generating a set of multi-input motion data comprising the set non-electrical data representative of cardiac motion and the one or more sets of motion data representative of respiratory motion; and

15 extracting one or more periods of minimal motion for one of a heart and a respiratory organ from the set of multi-input motion data.

11. The method, as recited in claim 10, wherein the one or more sets of data representative of respiratory motion comprise at least one of a set of electrical data representative of respiratory motion and a set of non-electrical data representative of respiratory motion.

12. The method, as recited in claim 10, wherein the set of multi-input motion data further comprises one or more sets of motion data for one or more proximate organs.

13. The method, as recited in claim 10, wherein the step of acquiring comprises measuring a set of non-electrical data representative of cardiac motion using mechanical sensors.

14. The method, as recited in claim 10, wherein the step of acquiring comprises measuring a set of electrical data representative of respiratory motion using electrical sensors.

15. The method, as recited in claim 10, wherein the step of acquiring comprises measuring a set of non-electrical data representative of respiratory motion using mechanical sensors.

5 16. The method, as recited in claim 10, wherein the step of acquiring comprises measuring one of cardiac motion and respiratory motion from one or more images.

10 17. The method, as recited in claim 16, wherein the one or more images are derived from one of pre-acquisition image data, unreconstructed acquisition image data, and reconstructed acquisition image data.

18. The method as recited in claim 10, further comprising the step of determining a set of motion compensation factors from the one or more periods of minimal motion.

15 19. The method as recited in claim 10, further comprising the step of determining two or more gating points from the one or more periods of minimal motion.

20 20. The method as recited in claim 1, further comprising the step of validating the one or more periods of minimal motion.

21. A method for identifying one or more periods of minimal motion, comprising the steps of:

25 acquiring at least one set of electrical data representative of cardiac motion, at least one set of non-electrical data representative of cardiac motion, and one or more sets of data representative of respiratory motion;

generating a set of multi-input motion data comprising the set of electrical data representative of cardiac motion, the set non-electrical data representative of cardiac motion, and the one or more sets of motion data representative of respiratory motion; and

30 extracting one or more periods of minimal motion for one of a heart and a respiratory organ from the set of multi-input motion data.

22. The method, as recited in claim 21, wherein the one or more sets of data representative of respiratory motion comprise at least one of a set of electrical data representative of respiratory motion and a set of non-electrical data representative of respiratory motion.

5

23. The method, as recited in claim 21, wherein the set of multi-input motion data further comprises one or more sets of motion data for one or more proximate organs.

10

24. The method, as recited in claim 21, wherein the step of acquiring comprises measuring a set of electrical data representative of cardiac motion using electrical sensors.

15

25. The method, as recited in claim 21, wherein the step of acquiring comprises measuring a set of non-electrical data representative of cardiac motion using mechanical sensors.

20

26. The method, as recited in claim 21, wherein the step of acquiring comprises measuring a set of electrical data representative of respiratory motion using electrical sensors.

27. The method, as recited in claim 21, wherein the step of acquiring comprises measuring a set of non-electrical data representative of respiratory motion using mechanical sensors.

25

28. The method, as recited in claim 21, wherein the step of acquiring comprises measuring one of cardiac motion and respiratory motion from one or more images.

30

29. The method, as recited in claim 28, wherein the one or more images are derived from one of pre-acquisition image data, unreconstructed acquisition image data, and reconstructed acquisition image data.

30. The method as recited in claim 21, further comprising the step of determining a set of motion compensation factors from the one or more periods of minimal motion.

31. The method as recited in claim 21, further comprising the step of determining two or more gating points from the one or more periods of minimal motion.

5 32. The method as recited in claim 21, further comprising the step of validating the one or more periods of minimal motion.

33. A computer program, provided on one or more computer readable media, for identifying one or more periods of minimal motion for a heart, comprising:

10 a routine for acquiring at least one set of electrical data representative of cardiac motion and at least one set of non-electrical data representative of cardiac motion;

a routine for generating a set of multi-input motion data comprising the sets of electrical and non-electrical data; and

15 a routine for extracting one or more periods of minimal motion for the heart from the set of multi-input motion data.

34. The computer program, as recited in claim 33, the routine for generating the set of multi-input motion data includes one or more sets of motion data for one or more proximate organs in the set of multi-input motion data.

20 35. The computer program, as recited in claim 33, wherein the routine for acquiring measures a set of electrical data representative of cardiac motion using electrical sensors.

25 36. The computer program, as recited in claim 33, wherein the routine for acquiring measures a set of non-electrical data representative of cardiac motion using mechanical sensors.

37. The computer program, as recited in claim 33, wherein the routine for acquiring measures the motion of the heart from one or more images.

30 38. The computer program, as recited in claim 37, wherein the one or more images are derived from one of pre-acquisition image data, unreconstructed acquisition image data, and reconstructed acquisition image data.

39. The computer program, as recited in claim 33, comprising a routine for determining a set of motion compensation factors from the one or more periods of minimal motion.

5

40. The computer program, as recited in claim 33, comprising a routine for determining two or more gating points from the one or more periods of minimal motion.

10

41. The computer program, as recited in claim 33, comprising a routine for validating the one or more periods of minimal motion.

42. A computer program, provided on one or more computer readable media, for identifying one or more periods of minimal motion, comprising:

15

a routine for acquiring at least one set of non-electrical data representative of cardiac motion and one or more sets of data representative of respiratory motion;

a routine for generating a set of multi-input motion data comprising the set non-electrical data representative of cardiac motion and the one or more sets of motion data representative of respiratory motion; and

20

a routine for extracting one or more periods of minimal motion for one of a heart and a respiratory organ from the set of multi-input motion data.

25

43. The computer program, as recited in claim 42, wherein the one or more sets of data representative of respiratory motion comprise at least one of a set of electrical data representative of respiratory motion and a set of non-electrical data representative of respiratory motion.

30

44. The computer program, as recited in claim 42, wherein the routine for generating the set of multi-input motion data includes one or more sets of motion data for one or more proximate organs in the set of multi-input motion data.

45. The computer program, as recited in claim 42, wherein the routine for acquiring measures a set of non-electrical data representative of cardiac motion using mechanical sensors.

46. The computer program, as recited in claim 42, wherein the routine for acquiring measures a set of electrical data representative of respiratory motion using electrical sensors.

47. The computer program, as recited in claim 42, wherein the routine for acquiring measures a set of non-electrical data representative of respiratory motion using mechanical sensors.

48. The computer program, as recited in claim 42, wherein the routine for acquiring measures one of cardiac motion and respiratory motion from one or more images.

49. The computer program, as recited in claim 48, wherein the one or more images are derived from one of pre-acquisition image data, unreconstructed acquisition image data, and reconstructed acquisition image data.

50. The computer program, as recited in claim 42, comprising a routine for determining a set of motion compensation factors from the one or more periods of minimal motion.

51. The computer program, as recited in claim 42, comprising a routine for determining two or more gating points from the one or more periods of minimal motion.

52. The computer program, as recited in claim 42, comprising a routine for validating the one or more periods of minimal motion.

53. A computer program, provided on one or more computer readable media, for identifying one or more periods of minimal motion, comprising:

a routine for acquiring at least one set of electrical data representative of cardiac motion, at least one set of non-electrical data representative of cardiac motion, and one or more sets of motion data representative of respiratory motion;

a routine for generating a set of multi-input motion data comprising the set of electrical data representative of cardiac motion, the set non-electrical data representative

of cardiac motion, and the one or more sets of data representative of respiratory motion;
and

a routine for extracting one or more periods of minimal motion for one of a heart
and a respiratory organ from the set of multi-input motion data.

5

54. The computer program, as recited in claim 53, wherein the one or more sets of
data representative of respiratory motion comprise at least one of a set of electrical data
representative of respiratory motion and a set of non-electrical data representative of
respiratory motion.

10

55. The computer program, as recited in claim 53, wherein the routine for generating
the set of multi-input motion data includes one or more sets of motion data for one or
more proximate organs in the set of multi-input motion data.

15

56. The computer program, as recited in claim 53, wherein the routine for acquiring
measures a set of electrical data representative of cardiac motion using electrical sensors.

57. The computer program, as recited in claim 53, wherein the routine for acquiring
measures a set of non-electrical data representative of cardiac motion using mechanical
sensors.

20

58. The computer program, as recited in claim 53, wherein the routine for acquiring
measures a set of electrical data representative of respiratory motion using electrical
sensors.

25

59. The computer program, as recited in claim 53, wherein the routine for acquiring
measures a set of non-electrical data representative of respiratory motion using
mechanical sensors.

30

60. The computer program, as recited in claim 53, wherein the routine for acquiring
measures one of cardiac motion and respiratory motion from one or more images.

61. The computer program, as recited in claim 60, wherein the one or more images are derived from one of pre-acquisition image data, unreconstructed acquisition image data, and reconstructed acquisition image data.

5 62. The computer program, as recited in claim 53, comprising a routine for determining a set of motion compensation factors from the one or more periods of minimal motion.

10 63. The computer program, as recited in claim 53, comprising a routine for determining two or more gating points from the one or more periods of minimal motion.

64. The computer program, as recited in claim 53, comprising a routine for validating the one or more periods of minimal motion.

15 65. An imaging system, comprising:

means for acquiring at least one set of electrical data representative of cardiac motion and at least one set of non-electrical data representative of cardiac motion;

20 means for generating a set of multi-input motion data comprising the sets of electrical and non-electrical data; and

means for extracting one or more periods of minimal motion for the heart from the set of multi-input motion data.

25 66. An imaging system, comprising:

means for acquiring at least one set of non-electrical data representative of cardiac motion and one or more sets of data representative of respiratory motion;

30 means for generating a set of multi-input motion data comprising the set non-electrical data representative of cardiac motion and the one or more sets of motion data representative of respiratory motion; and

means for extracting one or more periods of minimal motion for one of a heart and a respiratory organ from the set of multi-input motion data.

67. An imaging system, comprising:

means for acquiring at least one set of electrical data representative of cardiac motion, at least one set of non-electrical data representative of cardiac motion, and one or more sets of data representative of respiratory motion;

5 means for generating a set of multi-input motion data comprising the set of electrical data representative of cardiac motion, the set non-electrical data representative of cardiac motion, the one or more sets of motion data representative of respiratory motion; and

10 means for extracting one or more periods of minimal motion for one of a heart and a respiratory organ from the set of multi-input motion data.

68. An imaging system, comprising:

an imager configured to generate a plurality of signals representative of a heart;

data acquisition circuitry configured to acquire the plurality of signals;

15 data processing circuitry configured to receive the plurality of signals;

system control circuitry configured to operate at least one of the imager and the data acquisition circuitry;

20 an operator workstation configured to communicate with the system control circuitry and to receive at least the processed plurality of signals from the data processing circuitry;

one or more sensor-based motion measurement systems configured to measure electrical activity indicative of the motion of the heart; and

one or more sensor-based motion measurement systems configured to measure non- electrical activity indicative of the motion of the heart;

25 wherein one or more of the data processing circuitry and operator workstation are configured to extract one or more periods of minimal motion for the heart from a set of multi-input motion data comprising at least a set of electrical data representative of cardiac motion and a set of non-electrical data representative of cardiac motion acquired by the respective sensor-based motion measurement systems.

30 69. An imaging system, comprising:

an imager configured to generate a plurality of signals representative of at least one of a heart and a respiratory organ;

data acquisition circuitry configured to acquire the plurality of signals;
data processing circuitry configured to receive the plurality of signals;
system control circuitry configured to operate at least one of the imager and the
data acquisition circuitry;

5 an operator workstation configured to communicate with the system control
circuitry and to receive at least the processed plurality of signals from the data
processing circuitry;

one or more sensor-based motion measurement systems configured to measure
non-electrical activity indicative of the motion of the heart; and

10 one or more sensor-based motion measurement systems configured to measure
electrical or non- electrical activity indicative of the motion of the respiratory organ;

wherein one or more of the data processing circuitry and operator workstation
are configured to extract one or more periods of minimal motion for one of the heart and
the respiratory organ from a set of multi-input motion data comprising at least a set of
15 non-electrical data representative of cardiac motion and a set of electrical or non-
electrical data representative of respiratory motion acquired by the respective sensor-
based motion measurement systems.

70. The imaging system as recited in claim 69, wherein a sensor-based motion
20 measurement systems configured to measure non-electrical activity indicative of the
motion of the heart and a sensor-based motion measurement systems configured to
measure non- electrical activity indicative of the motion of the respiratory organ are the
same.

25 71. An imaging system, comprising:

an imager configured to generate a plurality of signals representative of at least
one of a heart and a respiratory organ;

data acquisition circuitry configured to acquire the plurality of signals;

data processing circuitry configured to receive the plurality of signals;

30 system control circuitry configured to operate at least one of the imager and the
data acquisition circuitry;

an operator workstation configured to communicate with the system control circuitry and to receive at least the processed plurality of signals from the data processing circuitry;

5 one or more sensor-based motion measurement systems configured to measure electrical activity indicative of the motion of the heart;

one or more sensor-based motion measurement systems configured to measure non- electrical activity indicative of the motion of the heart; and

one or more sensor-based motion measurement systems configured to measure electrical or non- electrical activity indicative of the motion of the respiratory organ;

10 wherein one or more of the data processing circuitry and operator workstation are configured to extract one or more periods of minimal motion for one of the heart and the respiratory organ from a set of multi-input motion data comprising at least a set of electrical data representative of cardiac motion, at least a set of non-electrical data representative of cardiac motion, and a set of electrical or non-electrical data
15 representative of respiratory motion acquired by the respective sensor-based motion measurement systems.

72. The imaging system as recited in claim 69, wherein a sensor-based motion measurement systems configured to measure non-electrical activity indicative of the
20 motion of the heart and a sensor-based motion measurement systems configured to measure non- electrical activity indicative of the motion of the respiratory organ are the same.